This year's theme was Learning Earth's Shapes and Colors. 149 topics were arranged into 7 sections, including:

- **Applications of Remote Sensing**
- **Mission and Programs**
- **Geoscience, Modeling, & Processing**
- **Data Processing & Algorithms**
- **Electromagnetic Problems**
- **Instrumentation & Techniques**
- **Policy, Societal Issues, & Education Initiatives**

Spaceborne Passive Microwave Measurement of Snowfall over Land

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Abstracts

A physically based retrieval algorithm was developed to estimate snowfall over land. The retrieval algorithm relies on the MM5 model that generates the vertical structure of a snow cloud, including snow mass, snow particle effective diameter, and water vapor. The MM5 cloud simulation was used to provide statistics for generating the cloud characteristics. The snow cloud profile and surface emissivity were then used in radiative transfer calculations that were optimized against AMSU-B observations at 89, 150 and 183.3±7, ±3, and ±1 GHz. The multi-parameter cloud model that produced brightness temperatures that best fit the AMSU-B observations was selected as the retrieved profile. The retrieved snowfall distribution was validated with radar reflectivity measurements obtained from the operational NWS radar network.

1. Introduction

Measurement of global precipitation is one of the goals of climate studies. Although most global precipitation occurs as rainfall, snowfall plays a significant role in the extra-tropical hydrological cycle. One important challenge for future satellites is to detect these snowstorms from space.

Because snow accumulation on land affects the emission properties of the surface, measurement of snowfall within the atmosphere has been difficult with radiometers that operate at frequencies where the atmosphere is relatively transparent. However, water vapor absorption at frequencies greater than 100 GHz can screen the emission from snow covered surfaces. The Special Sensor Microwave/T-2 (SSM/T-2) radiometer, and the Advanced Microwave Sounding Units (AMSU-B) radiometers on the NOAA 15,16, and 17 spacecraft, provide observations at 89, 150 and 183 $\pm$1, $\pm$3, $\pm$7 GHz. Snowfall over land has been empirically derived from the brightness temperatures at frequencies where water vapor absorption occurs by [1] and [2]. Although such empirical relationships are operationally useful, physical models, on which this study is focused, are needed to understand how the retrieved snowfall depends on the various ground-atmosphere factors that affect the measured brightness temperatures. This study presents a physical model of radiation at millimeter-wave frequencies that seeks to infer snowfall rates over land by taking advantage of water vapor screening to obscure the underlying snow-covered surface.

5. Validation and Discussion

Fig. 5 presents the NWS radar observed dBZ_{eff} shown in Fig.1 as a function of log(R) derived from this pixel matching technique for the retrieval results reported in Fig. 4. The comparison of the retrieved relationship to the previously published relationships is good. While this is not a rigorous validation of the retrieval results, it does show that this physical model enables retrievals to fall within the bounds of existing measured and empirical relationships.

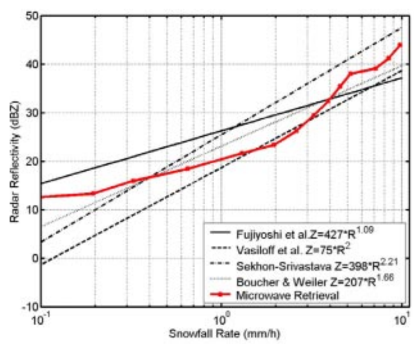

Fig. 5 Measured NWS radar reflectivity, Z, versus melted snowfall rate, R (mm/h). Blacklines show Z-R relations for snowfall shown in other studies.